WE CLAIM:

1. A connector for mechanically connecting hollow structures, in particular small vessels, comprising:

an annular member of deformable material, said member having a center line and a main plane, and being adapted to be permanently deformed by expansion from a first size in a starting position in which it is delivered to a desired anastomosis site, to a second, larger size in a joining position in which it connects the hollow structures,

circumferentially spaced means for joining abutting walls of the hollow structures together, said means including staple-like elements being adapted to be permanently deformed from a starting position in which the connector is delivered to a desired site, to a joining position in which they engage the hollow structures to connect them, said staple-like elements having at least two free ends and being attached to the annular member between its free ends and being tapered from the annular member towards their free ends.

2. The connector as claimed in claim 1, wherein at least the radial thickness of the staple-like elements is diminished towards the respective free ends.

3. The connector as claimed in claim 1, wherein a center line of each of the staple-like elements is disposed substantially within a radial plane of the annular member.

4. The connector as claimed in claim 2, wherein the staple-like elements are substantially straight in their starting position.

5. The connector as claimed in claim 3, wherein the staple-like elements have extreme tips which are preformed into the anticipated curve of the deformation to the joining position.

6. The connector as claimed in claim 1, wherein the connector is made from one piece of material.

7. The connector as claimed in claim 1, wherein parts of the staple-like elements on opposite sides of their

point of attachment to the annular member are configured differently.

8. The connector as claimed in claim 1, wherein the annular member is made up from a continuous elongated piece of material having a sinusoidal pattern meandering about a circumferential line through the main plane of the annular member.

9. The connector as claimed in claim 8, wherein the staple-like elements are formed at an apex of the sinusoidal pattern.

10. The connector as claimed in claim 1, wherein the main plane is at an angle to the center line of the annular member different from 90°.

11. An applicator for delivering and deploying a connector for mechanically connecting hollow structures, said connector including an expandable annular member and a plurality of deformable staple-like elements spaced around the circumference of the annular member, comprising:

a shank-like element;

a head formed at a distal end of the shank-like element, said head being adjustable in such a manner that the annular member and the staple-like elements of the connector are deformed from the starting position to the joining position when said adjusting takes place,

said head including an inner member and an outer member which are longitudinally slidable and include longitudinally opposite anvil formations which are movable to and from upon relative sliding movements of the inner and outer members in order to deform the staple-like elements to their joining position;

wherein both the inner and outer members are expandable to deform the connector to the joining position.

12. The applicator as claimed in claim 11, wherein both the inner member and the outer member is slitted in axial direction to allow expansion.

13. The applicator as claimed in claim 12, wherein the outer member includes at least first slits and second

slits, said first slits are arranged at an end of the outer member which forms part of the head and extends between the anvil formations, said second slits being spaced from said end of the outer member, and alternate with the first slits and are configured in overlapping arrangement.

14. The applicator as claimed in claim 12, adapted to expand the annular member and deform the staple-like elements in two steps, wherein the inner member is hollow and the applicator further comprises a tapered core member which is slidable through the inner member and is operatively connected to a control means to slide the core member into and out of the head to expand the inner and outer members.

15. The applicator as claimed in claim 13, wherein the core member and control means are used to control the relative movements of the inner and outer members as well.

16. The applicator as claimed in claim 11, wherein the anvil formations, on their sides facing each other, have curved surfaces dictating the deformation of the staple-like elements, said curved surfaces are formed to such an extent that they terminate at an angle to the longitudinal axis of the head which is slightly beyond 90°, for example 91°-120°.

17. The applicator as claimed in claim 16, wherein the curved surface is shaped as a circular segment which is slightly larger than 90°.

18. The applicator as claimed in claim 11, including a grip for handling the applicator, said grip being attached to the proximal end of the shank-like element and including the control means for actuating at least the inner and outer members.

19. An applicator for delivering and deploying a connector for mechanically connecting hollow structures, said connector including an expandable annular member and a plurality of deformable staple-like elements spaced around the circumference of the annular member, comprising:

a shank-like element;

a head formed at a distal end of the shank-like element, said head being adjustable in such a manner that the

annular member and the staple-like elements of the connector are deformed from the starting position to the joining position when said adjusting takes place,

said head including an inner member and an outer member which are longitudinally slidable and include longitudinally opposite anvil formations which are movable to and for upon relative sliding movements of the inner and outer members in order to deform the staple-like elements to their joining position;

said head further including an expansion member comprising wedges adapted to slide underneath the annular member.

20. The applicator as claimed in claim 19, wherein the expansion member is slidable relative to the inner and outer members.

21. The applicator as claimed in claim 20, wherein the wedges are interleaved with the anvil formations.

22. The applicator as claimed in claim 20, wherein the inner member is adapted to support the annular member in its starting position.

23. The applicator as claimed in claim 20, further including control means adapted to first actuate the inner and outer member to deform the staple-like elements to the joining position, and then to actuate the expansion member in order to expand the annular member to the joining position.

24. The applicator as claimed in claim 20, wherein the anvil formations on the inner member have an outer dimension which is smaller than the maximum outer dimension of the expansion member, such that the connector can be removed from the applicator in the distal direction over the anvil formations on the inner member.

25. The applicator as claimed in claim 22, wherein the expansion member includes a tube-like member arranged around the outer member, said tube-like member having the wedges attached to its distal end, said wedges extending inwardly to the outer surface of the inner member.

26. The applicator as claimed in claim 25, wherein

the outer member has indentations between the proximal anvil formations to accommodate the wedges in a starting position thereof.

27. The applicator as claimed in claim 11 ~~or 19~~, wherein the shank-like element is rigid.

28. The applicator as claimed in claim 11 ~~or 19~~, wherein the shank-like element is flexible.

29. An applicator for delivering and deploying a connector for mechanically connecting hollow structures, said connector including an expandable annular member and a plurality of deformable joining elements spaced around the circumference of the annular member, comprising:

a shank-like element;

a head formed at a distal end of the shank-like element, said head including an anastomosis portion which is adjustable in such a manner that the annular member and the joining elements of the connector are deformed from the starting position to the joining position when said adjusting takes place, said head further including a punching portion distally of the anastomosis portion and including two relatively movable parts configured to cause a punching action on a wall of the hollow structure and to catch a punched-out part of said wall.

30. The applicator as claimed in claim 29, wherein the two parts of the punching portion are axially movable and include a distal part shaped to be inserted into an arteriotomy of the hollow structure, and a proximal part, ~~said~~ distal and proximal parts including cooperating knife members facing each other and adapted to catch the punched-out part between said distal and proximal parts.

31. The applicator as claimed in claim 30, wherein the anastomosis portion and the puncture portion are supported by a core member extending through the head of the applicator.

32. The applicator as claimed in claim 29, wherein a distal front of the punching portion of the head comprises cutting means to cut an arteriotomy in one of the hollow structures.

33. A method of delivering and deploying a connector for mechanically connecting hollow structures, said method comprising the steps of:

providing a connector for joining adjacent walls of the hollow structures,

providing an applicator for said connector, said applicator including cutting means,

making an arteriotomy in the wall of one of the hollow structures,

inserting the cutting means of the applicator partly into said one of the hollow structures through the arteriotomy, so as to cut a hole in the wall,

advancing the applicator up to a desired position,

deploying the connector by means of the applicator so as to connect the walls of the hollow structures.

34. The method as claimed in claim 32, wherein the arteriotomy is made by a second cutting means provided on a distal front of the applicator.

35. An applicator for delivering and deploying a connector for mechanically connecting hollow structures, said connector including an expandable annular member and a plurality of deformable joining elements spaced around the circumference of the annular member, comprising:

a shank-like element; and

a head formed at a distal end of the shank-like element, said head including an anastomosis portion which is adjustable in such a manner that the annular member and the joining elements of the connector are deformed from the starting position to the joining position when said adjusting takes place, said head having a distal front which comprises cutting means to cut an arteriotomy in one of the hollow structures.

36. A connector for mechanically connecting hollow structures, in particular small vessels, comprising:

an annular member of deformable material, said member having a center line and a main plane, and being adapted to be permanently deformed by expansion from a first size in a

starting position in which it is delivered to a desired anastomosis site, to a second, larger size in a joining position in which it connects the hollow structures,

circumferentially spaced means for joining abutting walls of the hollow structures together, said means including staple-like elements being adapted to be permanently deformed from a starting position in which the connector is delivered to a desired site, to a joining position in which they engage the hollow structures to connect them,

wherein the main plane through the annular member and the center line thereof are at an angle to each other.

37. A connector for mechanically connecting hollow structures, in particular small vessels, comprising:

an annular or tubular member of deformable material, said member being adapted to be permanently deformed from a first size in a starting position in which it is delivered to a desired site, to a second, larger size in a joining position in which it connects the hollow structures,

circumferentially spaced means for joining abutting walls of the hollow structures together, said means including staple-like elements being adapted to be permanently deformed from a starting position in which the connector is delivered to a desired site, to a joining position in which they engage the hollow structures to connect them, said staple-like elements being attached to the annular member near their center and extend in a direction parallel to the center line of the annular member.